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(54) Abstract Title
A router tiltably mounted on a base

(57) A router comprises a body 10 containing a cutter means 42 and mounted on two legs 12 which are pivotably mounted on a base 11. Pivoting of the legs 12 is achieved by placing cylinders 13 and 14 attached to the ends of respective legs 12 in housings 16. The angle of the body 10, cutter means 42 and legs 12 relative t the base 11 is determined by means of a graduated scale 18 on one of the cylinders 14 and a reference mark 19 on the base 11. Cutting depth is controlled by means of one or more depth stops 21-23 mounted on a revolving turret 20 attached to one of the cylinders 13. A guide fence (31, figs. 3-5) may be attached to the router in a first orientation (Fig. 3) using a pair of rods 35. The guide fence (31, figs. 3-5) may also be attached to the router in a second orientation (Fig. 5) at 90 degrees to the first using a combination of two pairs of rods (33 and 35, figs. 4 and 5) and a pair of brackets (32, figs. 4 and 5).

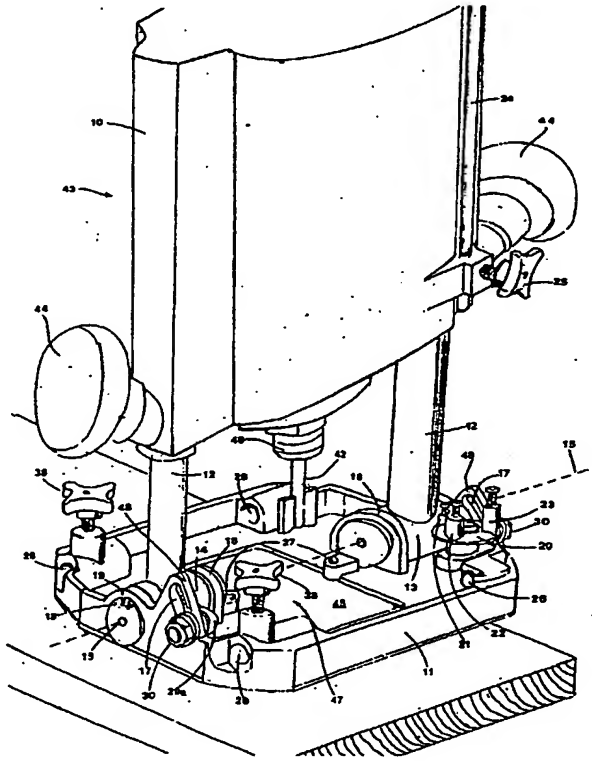

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Figure 1.

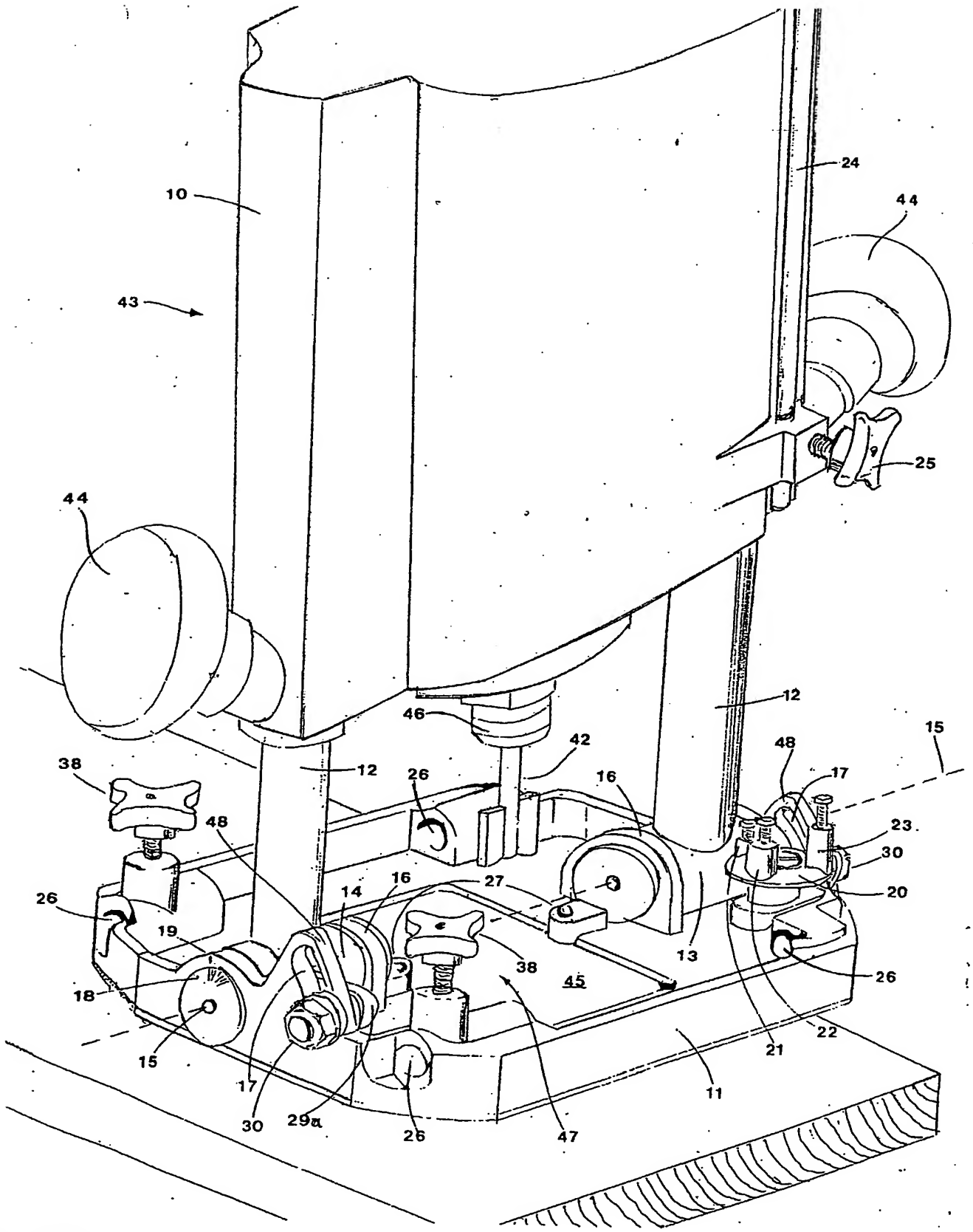


Figure 2.

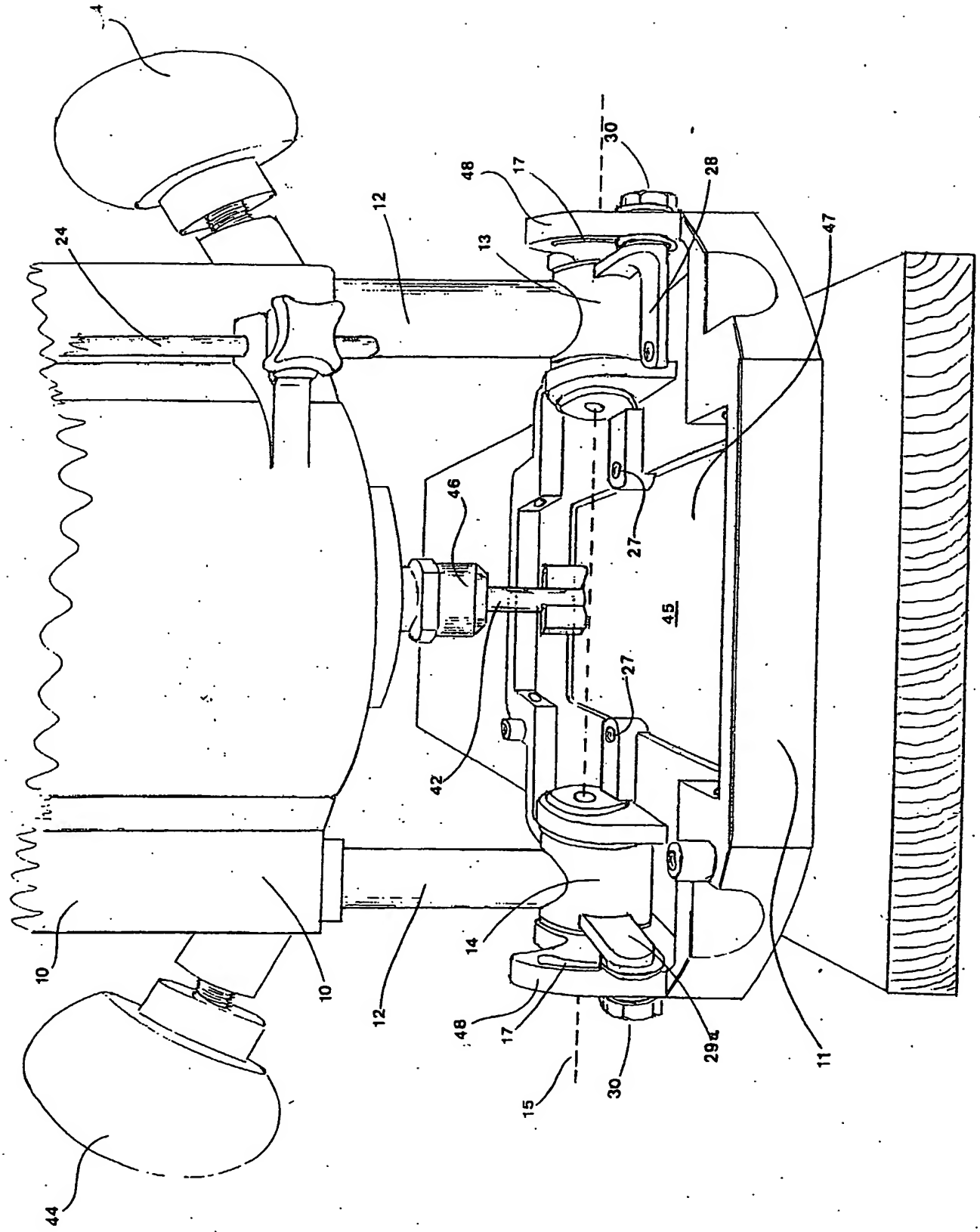


Figure 3

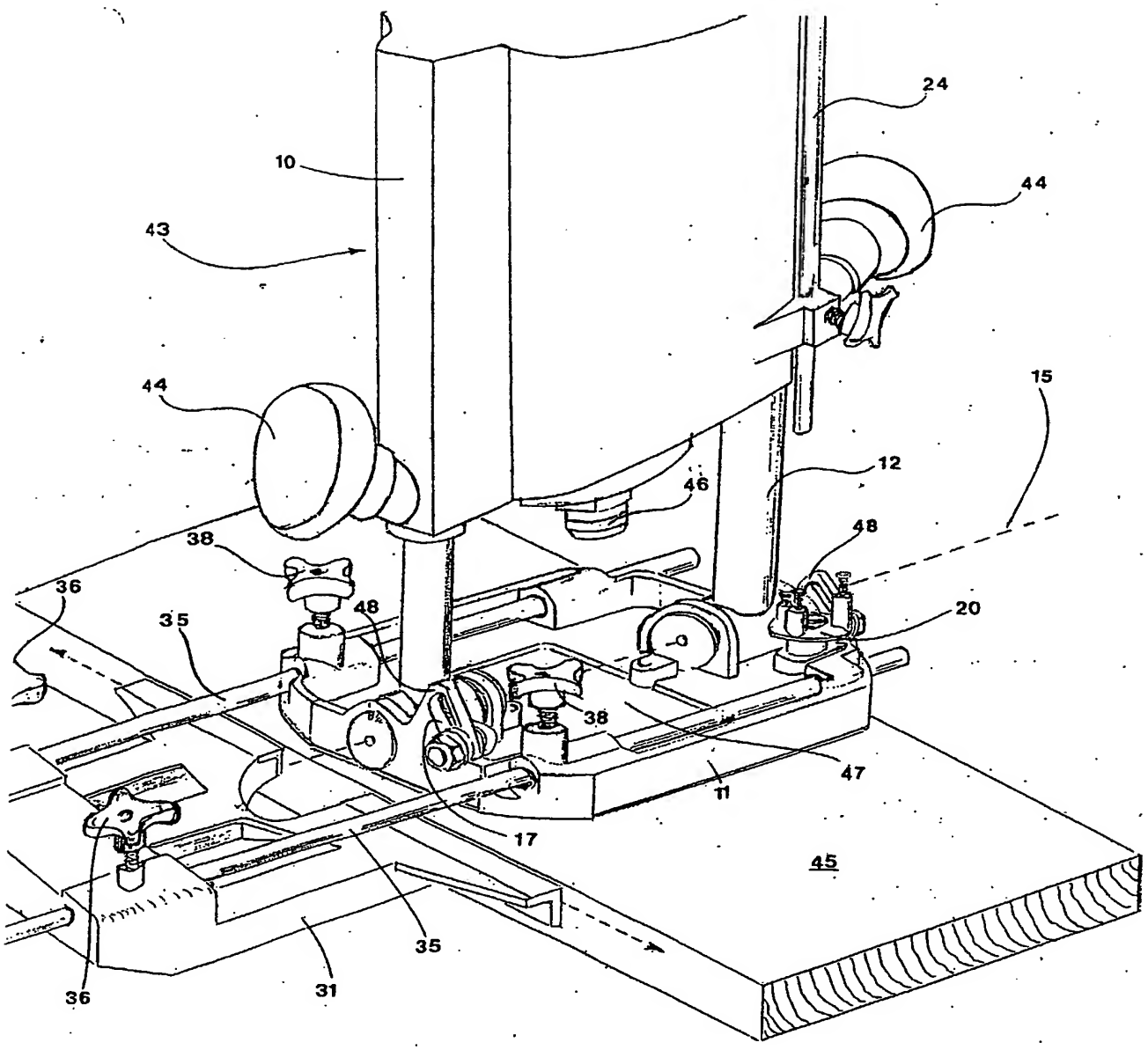


Figure 4

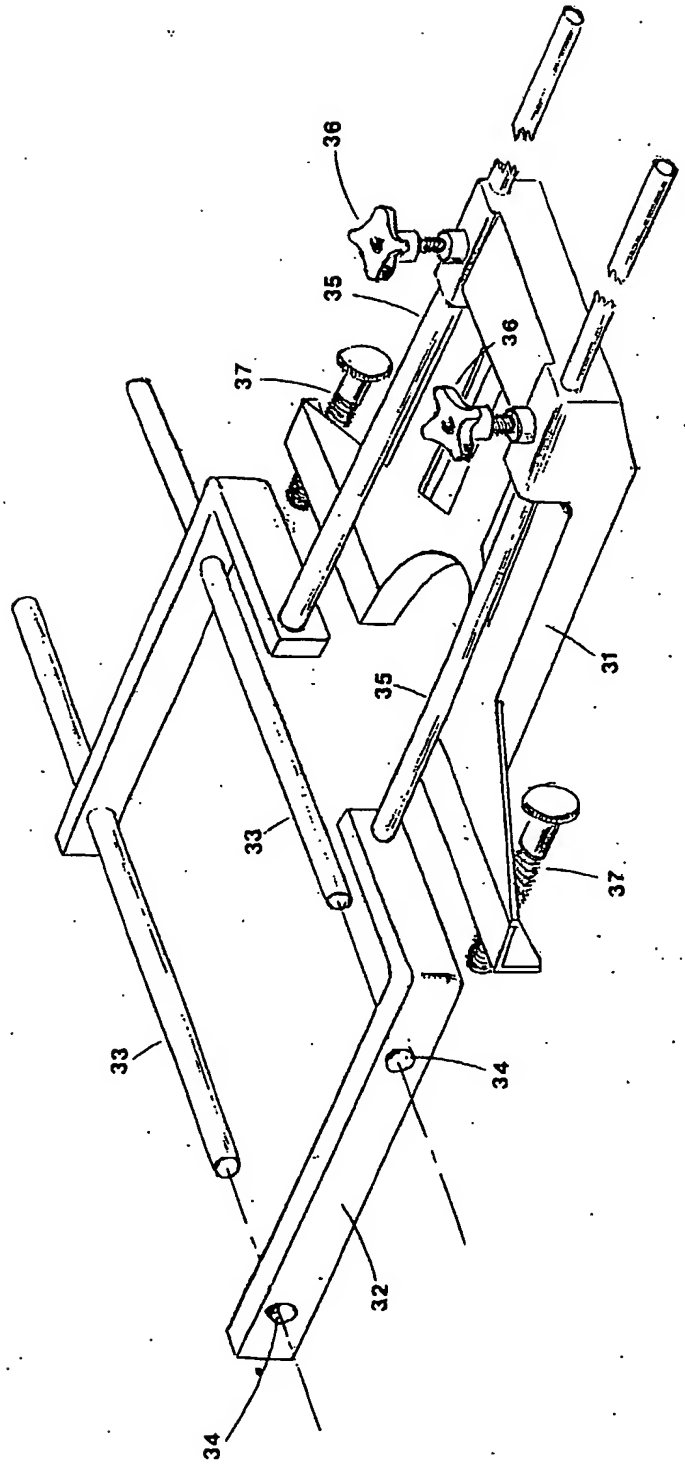


Figure 5

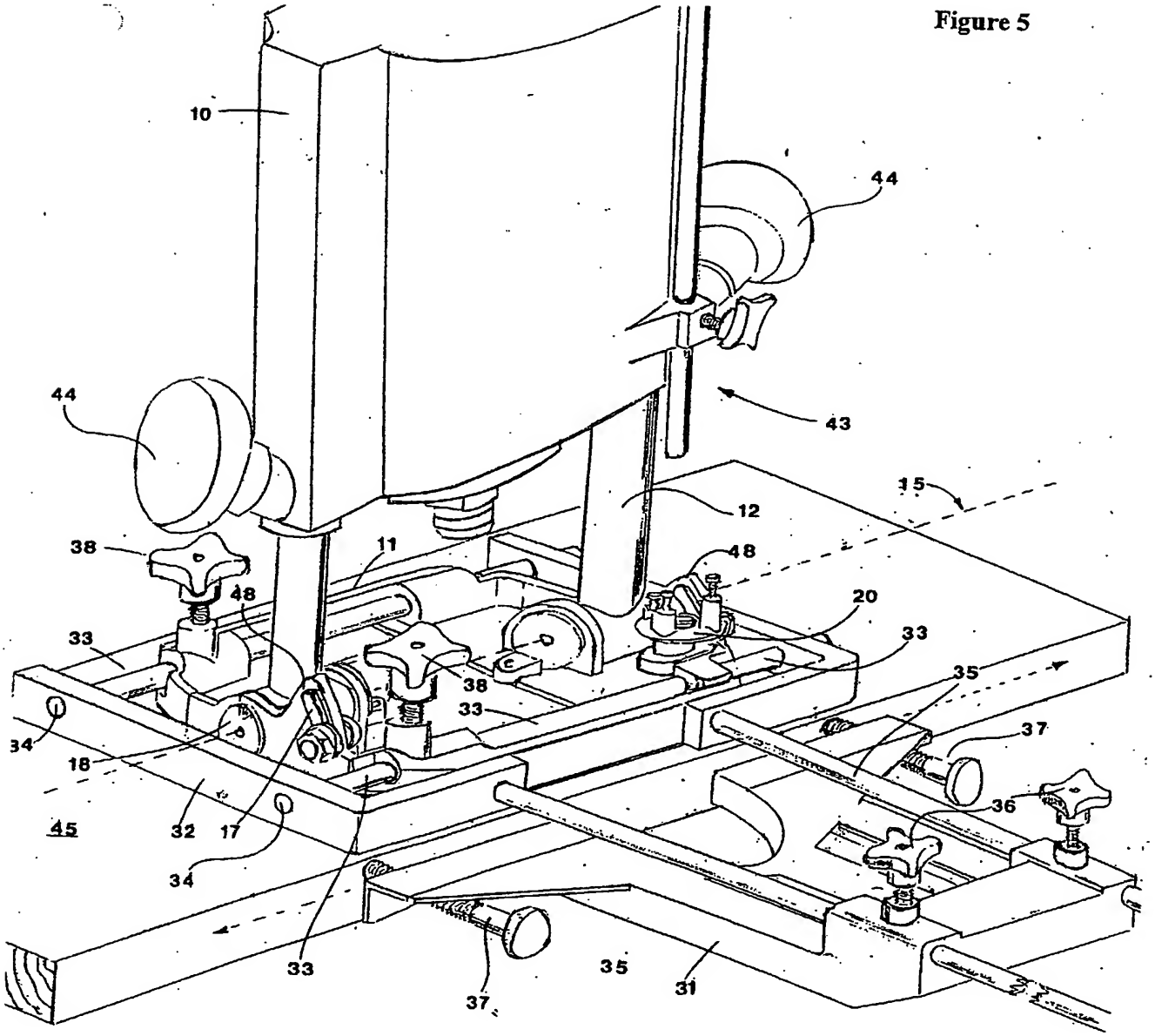
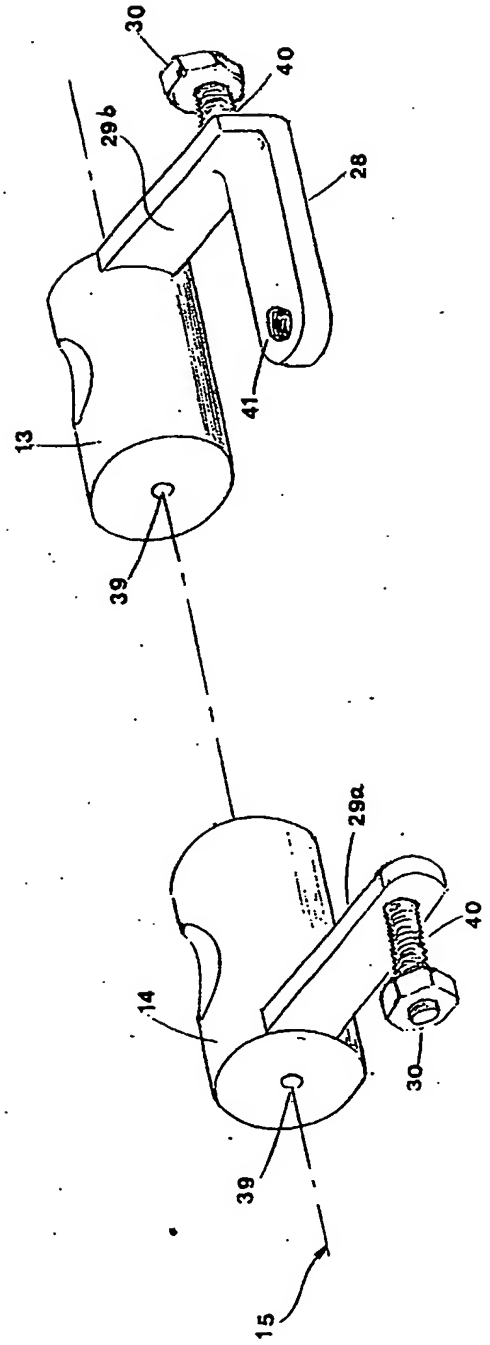


Figure 6



A Router

The present invention relates to routers.

Routing machines or routers are well known and consist of a main body, a base means and an electrically powered motor which drives a rotating cutter. The base means is placed onto a workpiece when the router is in hand-held use. When fixed to a router table, the base means is in contact with the underside of the table and the workpiece is in contact with the table top. Furthermore, the router may be suspended from a frame for 'overhead' routing.

The cutter is used to cut internal and external ends and edges into the workpiece, which may be a piece of wood, plastic or other sheet material, to a pre-determined profile for either decorative or jointing purposes. The cutter may be either straight or shaped and used to cut bevels and/or mitres across the width of a board or sheet material or to remove material from any point within the surface area of a board or sheet material. In addition, the router may be used in conjunction with a shaped template, guide bar or fence to assist the cutting process.

The router may be hand held and passed along the workpiece, or be fitted to the underside of a table, with the cutter protruding through a hole in the table surface, which allows the workpiece to be passed through the rotating cutter. With either method, the router body and the cutter shank are permanently fixed at ninety degrees to the router base means, thus imposing restrictions on

the angles and profiles of cuts or routs which may be achieved in the workpiece.

Various designs have been proposed for permitting portable routers to be held at an angle to the workpiece, thereby enabling an increased range of angles and shapes of bevels and mitres to be cut. All of these designs, for example, as described in US 6138372 are in the form of attachments which are fitted to the router. However, they are often difficult to set up, and time consuming to use, particularly where similar repetitive cuts are made to various sections or parts of the workpiece. In the design described in US 6,138,372, further adaptations must be made and attachments fitted when routing the edges of boards less then 200mm wide and/or a thickness of plus or minus 18mm. With such attachments fitted to portable routers described above, it is impossible to use the router:-

a. in a router table;
b. when a template guide is fitted to the router;
c. for internal cuts in the workpiece;
d. on workpieces longer than the guide bar;
e. for routing other than on the end or edge of a workpiece board; and
f. to route edges in the shape of a curve.

It is an aim of embodiments of the present invention to address the problems outlined above.

According to a first aspect of the present invention there is provided a router comprising base means, cutting means for cutting into a workpiece and adjustment means, wherein

the adjustment means are operable to pivot the base means and the cutting means with respect to each other.

The base means may be operable to support the router on the workpiece.

The router may be used in conjunction with a router table. When the router is used in conjunction with a router table, the base means may be operable to abut a first side of the router table, and the workpiece may be operable to abut a second side of the router table.

Preferably, the router comprises a body attached to the base means, the body preferably housing a motor which motor is operable to drive the cutting means. The cutting means may be pivotable either in a clockwise or anti-clockwise direction. Preferably, the cutting means is removeably held in a chuck which extends out of the body. Preferably, the chuck is a collet chuck and, preferably, may be tightened to hold the cutting means.

Preferably, the router base means is substantially planar and, more preferably, has an aperture which extends therethrough, through which the cutting means may pass to the workpiece. The base means may be a baseplate.

The attachment of the body to the base means may comprise the adjustment means. Preferably, the body is attached to the base means by means of at least one substantially elongate leg. Preferably, the body is attached to the base means by means of two substantially elongate legs. Preferably, the ends of the legs distal from the body form hinge means, which may be the adjustment means, between

the legs and the base means about which the base means is tiltable. Preferably, the hinge means together form an axis which is generally in a plane substantially parallel to the base means.

Preferably, the base means is tiltable with respect to the cutting means along said axis.

Preferably, the end of the or each leg distal from the body is operably attached to a cylinder, which cylinder is preferably rotatably housed within a cylinder housing. Preferably, rotating the cylinder in the housing results in the tilting of the body and, preferably, cutting means with respect to the base means.

Preferably, at least one flange extends substantially perpendicularly away from the base means. Preferably, the flange is substantially quadrant shaped. Preferably, the base means comprises two opposing flanges which extend substantially perpendicularly away from the base means towards the cutting means.

Preferably, the or each flange comprises a slot extending therethrough, the slot being preferably quadrant or arc shaped, preferably centred on the axis of the hinge means.

Preferably, the or each cylinder is in operable communication with the flange and preferably the slot. Preferably, the or each cylinder comprises an arm which extends substantially transversely outwardly therefrom. Preferably, the arm has a shank extending substantially transversely outwardly therefrom, which shank is operable to extend through the slot in the flange.

Preferably, the angle of the router body and, hence, cutting means may be adjustable with respect to the router base means by adjusting the position of the shank along the arc of the slot. Advantageously, tilting the router body about the axis causes the cylinders to rotate within their respective housings and the shanks to be displaced along the arc in the slot.

Preferably, the router comprises means for visually determining the angle of the cutting means with respect to the base means. Preferably, said means comprises a graduated scale on the rotatable cylinder and a fixed reference mark which is present on the side of the base means.

Advantageously, the operator can accurately determine the angle of tilt of the router body and cutting means with respect to the base means by gauging the respective positioning of the fixed mark and the graduated scale.

Preferably, the router comprises means for locking the body and, preferably, the cutting means at any selected angle with respect to the base means. Preferably, the shank which extends through the slot is threaded. A suitably threaded nut may be screwed onto the shank to abut the flange thereby locking the cylinder and, preferably, cutting means at the desired angle with respect to the base means.

For the sake of clarity, angles hereinafter referred to describe the angle of tilt of the cutting means with respect to the router base means. The plane of the router

base means is designated as 0°. When in the upright position, the angle defined by the cutting means to the router base means, i.e. perpendicular to the base means, is designated as 90°.

Preferably, the cutting means is pivotable so that it makes an angle of at least 75° with respect to the router base means, more preferably, at least 60°, even more preferably, at least 45°, still more preferably, at least 30°, and most preferably, at least 15° to the router base means.

Advantageously, such adjustment of the tilt of the cutting means with respect to the base means enables the routing of bevels and mitres onto the sides and ends of straight-edged or curved workpieces, and mitres at any point across the width of the workpiece at virtually any angle ranging from between a 90°, ie when the router body 10 is vertical with respect to the workpiece, and a minimum of about 10°-20°, ie when the router body is close to horizontal with respect to the workpiece.

Preferably, the router comprises means for adjusting the depth to which the cutting means may move towards the workpiece. Preferably, at least one of the cylinders comprises a revolving turret attached thereto to which is attached at least one depth stop which may be adjusted to vary the height to which the cutting means may be lowered above the base means. Preferably, the turret comprises three depth stops each of which is adjustable by means of a machine screw fitted, preferably, into a threaded hole, preferably, at the top of each stop. Preferably, and advantageously, screwing the machine screw either into or

out of the stop, raises or lowers the machine screw, thus enabling fine adjustment of the depth stop.

The depth stop may operate in conjunction with a rod which is adjustably slidable along the side of the router body along an axis perpendicular to the base means. The rod may be locked in position, by a clamping screw which is fixed to the body of the router at the desired point within its range of travel.

Preferably, the router is positively stopped when in a vertical position.

Advantageously, in conjunction with either of the three different depth stops as chosen by the user with which it may abut, the rod pre-determines the distance the router body and, hence, cutter can travel towards the base means and workpiece.

Preferably, the router comprises means for attaching a guide bar and preferably a guide fence to assist in the cutting process. Preferably, the base means of the router comprises suitably sized apertures to accommodate the guide bar and/guide fence thereto. Preferably, the guide fence and, preferably, the guide bar may be attached to the router base means at 90° to its usual position and adjacent to the angle of tilt.

The router may be operated in the hand held manner, or used inverted and fixed to the underside of a router table. The router may be fitted with a template follower. Preferably, the router comprises at least one handle attached to the side thereof to assist an operator to move

the router body and cutting means through the aperture either towards or away from the workpiece.

According to a second aspect of the present invention, there is provided a method of routing a workpiece using a router comprising base means, cutting means and adjustment means, the method comprising the steps of:-

i) placing the base means onto said workpiece to support the router; and

ii) pivoting the adjustment means so that the angle between the base means and the cutting means is varied.

Preferably, the method further comprises the step of locking the cutting means at the desired angle to the base means.

All of the features described herein may be combined with any of the above aspects, in any combination.

For a better understanding of the invention, and to show how embodiments of the same may be carried into effect, reference will be made, by way of example, to the accompanying diagrammatic drawings, in which:-

Figure 1 is a perspective view of router fitted with an adjustable base means;

Figure 2 is an alternative perspective view of the router;

Figure 3 is a perspective view of the router fitted with the adjustable base means and a guide fence;

Figure 4 is a perspective view of the guide fence fitted to a guide fence bracket;

Figure 5 is a perspective view of the router fitted with the adjustable base means, guide fence and guide fence bracket; and

Figure 6 is an exploded perspective view of a section of the adjustable base means.

Referring to Figure 1, there is shown a router 43 having a main body section 10 which is secured via two elongate router pillars 12 to a substantially planar base means 11. The base means 11 is adjustable with respect to the body section 10 in that it is tiltable in the vertical plane, i.e. along the longitudinal axis of the router body section 10.

In a normal position, the base plate 11, which has an open section 47 in the centre thereof, rests on a flat workpiece 45 and the router body extends generally upwardly at an angle of 90° to the workpiece 45. A removable cutter 42 extends generally downwardly from the underside of the body 10 and is held in the router body 10 by a collet chuck 46. The cutter 42 is powered by a motor (not shown) located within the body 10 and rotates normally at variable speeds, either clockwise or anti-clockwise depending on the orientation of the router 43 with respect to the workpiece 45, passing through the base means open section 47 to make cuts into the workpiece 45 as desired. Handles 44 are provided on either side of the body 10 to assist a user to move the router body 10 and

cutter 42 through the open section 47 in the base means 11 either up or down towards or away from the workpiece 45. The extent of movement or depth which the router body 10 and, hence, cutter 42 may travel may be adjusted and fixed by means of a revolving turret depth stop 20 which is described in more detail hereinafter.

It should be appreciated that the router 43 as shown in the diagrams is a hand-held router 43. However, the router 43 may be used in conjunction with a router table (not shown). In such cases, when the router 43 is used in conjunction with a router table, the base means 11 abuts a first side of the router table, and the workpiece 45 abuts a second side of the router table.

The ends of the router pillars 12 distal from the router body 10 are received in cylinders 13,14 which are attached to either side of the tiltable base means 11. The cylinders 13,14 are shown in more detail in Figure 6 and each forms a pivot point between the router pillars 12 (and hence the router body 10) and the base means 11. The two pivots 13,14 together define a central axis 15 which is generally parallel to the base means 11 and hence workpiece 45. Adjustment of the angle of the body 10 with respect to the base means 11 by tilting about the hinge points 13,14 enables the routing of bevels and mitres onto the sides and ends of straight-edged or curved workpieces 45, and mitres at any point across the width of the workpiece 45, at virtually any angle ranging from between a maximum of 90°, ie wherein the router body 10 and hence rotating cutter 42 are substantially perpendicular to a workpiece 45, and a minimum of about 10°-20°, ie wherein the router body 10 and hence rotating cutter 42 are at a

more acute angle to a workpiece. The maximum and minimum range of angles obtainable between the router body 10 and tiltable base means 11 are described below. The router 43 may be operated in the hand held manner, or used inverted and fixed to the underside of a router table or workpiece 45.

In more detail, Figure 6 shows the cylinders 13,14 which are rotatably attached to the base means 11 via fixed cylinder housings 16. Extending perpendicularly from the cylinder 13 is a shank 29b, and extending perpendicularly from this shank 29b in a plane which extends in a direction generally inwardly and parallel to the cylinder 13 is an arm 28. The arm 28 is generally flattened in the horizontal plane and at the distal end thereof is a threaded aperture 41 extending therethrough. The revolving turret depth stop 20 as shown in Figure 1 is attached to the base means 11 via the threaded aperture 41 of arm 28. Therefore, the depth stop 20 moves in unison with the router pillars 12 and router body 10 as the latter are tilted about axis 15.

Cylinder 14 has an arm 29a extending perpendicularly away therefrom. The arms 28 and 29a further comprise fixed threaded shanks 40 which extend perpendicularly outwardly therefrom. The shanks 40 each pass through a quadrant, arc-shaped guideway slot 17 which extends around flanges 48 which extend generally perpendicular to either side of the base means 11. By adjusting the position of shanks 40 along the arc of the slots 17 (along arrow X) shown in figure 1, the angle of the router body 10 and, hence, cutter 42 may be adjusted with respect to the router base means 11. Tilting the router body 10 about axis 15, i.e.

generally towards and away from the plane of the page, causes the cylinders 13, 14 to rotate within their respective housings 16 and the shanks 40 to be displaced along the arc as shown by arrow X in the guideway slots 17. The router body 10 may be locked at any point within its range of tilt with respect to the base means 11 by locking nuts 30 which are screwed onto the ends of each threaded shank 40 of the cylinders 13, 14.

Referring in more detail to Figure 1, there is shown an angle gauge 18 which rotates together with the horizontal cylinders 13, 14 and registers against a fixed mark 19 on the outer side of base means 11. Using the angle gauge 18 and mark 19, the user can accurately determine the angle of tilt of the router body 10 and cutter 42 with respect to the base means 11 and, hence, workpiece 45. The revolving turret 20 which is fixed to the horizontal cylinder 13 by arm 28 provides three adjustable depth stops 21, 22, 23 each of a different height above the base means 11. The depth stops, low 21, medium 22 and high 23 operate in conjunction with a rod 24 which is adjustably slidable along the side of the router body 10 along an axis perpendicular to the base means 11. The rod 24 may be locked in position, by a clamping screw 25 which is fixed to the body of the router 10, at the desired point within its range of travel. In conjunction with either of the three different depth stops 21, 22, 23, as chosen by the user, with which it may abut, the rod 24 thereby pre-determines the distance the router body 10 and, hence, cutter 42 can travel towards the base means 11 and workpiece 45. Each of the three depth steps 21, 22, 23 is adjustable by means of a screw fitted into a threaded hole at the top of each stop. Screwing the machine screw

either into or out of the stop, raises or lowers the machine screw head, thus enabling fine adjustment of each depth stop, 21, 22, 23.

Referring to Figure 2, there are shown two template guide fixing points 27 which are located towards the inner side of the open section 47 in the base means 11. The template guide fixing points 27 permit the use of an attachable template follower (not shown) if necessary. In Figure 2 the revolving turret 20 is absent in order to show the arm 28 extending from the cylinder 13. Arm 29a which is connected to cylinder 14 is also shown. Figure 2 shows the relative positioning of the cylinders 13, 14 which are securely attached to the ends of the router pillars 12 and which are rotatable about axis 15 within the fixed cylinder housings 16.

Referring to Figure 3 there is shown the router 43 fitted with a guide fence 31 which assists the router to be moved along the workpiece 45 in a plane generally at 90° to axis 15 and parallel to the edge of the workpiece 45.

Referring to Figure 4 there is shown the guide fence 31 in more detail. The fence 31 is fitted to the router 43 as follows. The router base means 11 has holes 26 which form channels which extend therethrough in a plane parallel to the workpiece 45. The holes 26 accommodate two parallel rods 35 which extend out of the fence 31 and which are secured in place in the holes 26 by clamping screws 38. Threaded nylon screws 37 may be adjusted to contact the edge of a curved workpiece 45 allowing the router to follow the curve.

Figure 4 also shows the guide fence 31 in conjunction with a guide fence bracket 32 for use when the router 43 is used in hand held tilted mode and which permits the guide fence 31 to be mounted to the router base means 11 at ninety degrees to its usual position and adjacent to the angle of tilt. The fence bracket 32 consists of two L-shaped members which abut the base means 11.

Referring to Figure 5 there is shown the router 43 fitted with the swinging base means 11, the guide fence bracket 32 and guide fence 31 for routing in the hand held tilted mode. The guide fence bracket securing rods 33 are secured within the holes 26 of the base means 11 by clamping screws 38. The guide fence 31 and guide fence bracket 32 fitted as shown in figure 5 assist the router 43 to be moved along the workpiece 45 in plane generally along axis 15.

Advantages of the router 43 described herein reside in the adjustability of the angle of the router body 10 and, hence, cutter 42 with respect to the router base 11. Adjustment of the tilt of the body 10 with respect to the base means 11 about the hinge cylinders 13,14 enables the routing of bevels, mitres and other decorative profiles onto the sides and ends of straight-edged or curved workpieces 45, and mitres at any point across the width of the workpiece 45, at virtually any angle ranging from between a 90°, ie when the router body 10 is vertical to the workpiece 45, and a minimum of about 10°-20°, ie when the router body 10 is close to a horizontal angle to the workpiece 45. The angle gauge 18 and reference point 19 allow the operator to accurately measure the angle of tilt. Such adjustability enables the operator to use the

router 43 at 90° and at angles other than 90° to the workpiece 45 in a router table, with or without a template guide fitted, for internal cuts, on workpieces 45 of any length and/or thickness for routing other than on the end of edge of a board and to rout the edges of a curve. None of these are possible with currently available routing machines.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extend to any novel one, or any novel combination, of the features disclosed

in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed

CLAIMS

1. A router comprising base means, a body containing a cutting means for cutting into a workpiece and an adjustment means, wherein the adjustment means is operable to pivot the base means and the cutting means with respect to each other.

2. A router as claimed in Claim 1, wherein the attachment of the body, and thus the cutting means to the base means comprises the adjustment means.

3. A router as claimed in Claim 1 and Claim 2 wherein the attachment of the body to the base means form the hinge mean which may be the adjustment means, about which the base means is tiltable.

4. A router as claimed in any preceding claim, wherein the hinge means together form an axis which is generally in a plane substantially parallel to the base means.

5. A router as claimed in any preceding claim, wherein the router contains a graduated scale on the hinge means and a fixed reference mark on the base means which together comprise a means for visually determining the angle of tilt of the cutting means with respect to the base means.

6. A router as claimed in any preceding claim, wherein the router comprises a means of locking the body of the router at any selected angle with respect to the base means.

7. A router as claimed in any preceding claim, wherein, when in the upright position, the angle defined by the cutting means to the router base means, i.e. perpendicular to the base means, is designated at ninety degrees.

8. A router as claimed in Claim 3, wherein the body of the router and thus the cutting means is tiltable so that it makes an angle of at least seventy degrees with respect to the router base means.

9. A router as claimed in Claim 3, wherein the body of the router and thus the cutting means is tiltable so that it makes an angle of at least sixty degrees with respect to the router base means.

10. A router as claimed in Claim 3, wherein the body of the router and thus the cutting means is tiltable so that it makes an angle of at least forty five degrees with respect to the router base means.

11. A router as claimed in Claim 3, wherein the body of the router and thus the cutting means is tiltable so that it makes an angle of at least thirty degrees with respect to the router base means.

12. A router as claimed in Claim 3, wherein the body of the router and thus the cutting means is tiltable so that it makes an angle of at least fifteen degrees with respect to the router base means.

13. A router as claimed in any preceding claim, wherein the router comprises a means for adjusting the depth to which the cutting means may move towards the workpiece.

14. A router as claimed in any preceding claim wherein the router base means comprises means for attaching a guide fence bracket and guide fence.

15. A router as claimed in Claim 14, wherein the guide fence bracket permits the guide fence to be fitted at ninety degrees to its usual position and adjacent to the angle of tilt.